MARTIAN PLAINS VOLCANISM IN SYRIA PLANUM AND TEMPE MAREOTIS AS ANALOGS TO THE EASTERN SNAKE RIVER PLAINS, IDAHO: SIMILARITIES AND POSSIBLE PETROLOGIC CONTRIBUTIONS TO TOPOGRAPHY.

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Introduction: Prior to the Mars Global Surveyor (MGS) and Mars Odyssey (MO) missions, The Syria Planum region of Mars was noted for several clusters of small (5-100 km) shield volcanoes and collapse craters, long tube and fissure-fed lava flows, and possible volcanic vents that were thought to be nearly contemporaneous with the volcanism in the Tempe-Mareotis province (e.g. [1]), which has long been known for volcanic shields and vents analogous to those of the Eastern Snake River Plains (ESRP) in Idaho [2-6]. Recent MGS-based work on regional and global populations of martian small shields (e.g. [7-10]) has revealed significant global trends in edifice attributes that are well-explained by eruption models with latitudinal variations in subsurface water/ice abundance (e.g. [8, 9]), consistent with recent [11] MO evidence for significant amounts of subsurface water that varies in latitude abundance s, and topographic and morphologic evidence for more geologically recent lava-ice relationships [12, 13]. However, while the global trends in small volcano data can be at least partially explained by volatile interactions with volcanism, some global and regional characteristics appear to be perhaps better explained by possible compositional, crystallinity or eruption style variations [14-15]. This study expands the sampling of shields done in martian initial global studies (e.g.[8]) for the Syria Planum and Tempe-Mareotis regions, which display a newly visible breadth and number of features in image and topography data. We compare these features to a similar range of features visible in the ESRP where both compositional and eruption style variations can quantitatively be shown to contribute to morphologic and topographic differences [4-6, 14-15].

Data and Analysis:

Syria Planum and Tempe-Mareotis. For Syria Planum and the Tempe-Mareotis regions, we use the MOLA data to construct a local crossover-corrected topography grid at 128 pixels/deg. longitude by 256 pixels/deg. latitude using the approach of Neumann et al. [16]. For example, Fig. 1 shows a Mars Orbiter Laser Altimeter (MOLA) topographic grid displayed as a shaded relief plot as well as the preliminary data locations displayed for small edifices studied within Syria Planum. Topographically, these features display characteristics consistent with small shield origins such as radial flow patterns, summit craters, edifice clusters, and association with tube and vent—fed flows. It is notable that the handful of features previously visible in Viking Orbiter images are primarily the summit areas of the larger shields, and that there are easily an order of magnitude more features visible in the topography than previously detected. At least some of these newly visible features (locally or globally) can be correlated with the available MGS Mars Orbiter Camera (MOC) narrow angle or MO Thermal Emission Imaging System (THEMIS) images, sometimes revealing summit vent or flow detail structures. We use a suite of tools within the IDL-based *Gridview* program [17] to measure parameters such as volcano diameter, height, volume, area, crater diameter, local flank slope, etc as in prior studies [7-10, 13-15]. Fig. 2 shows a comparison of trends in global and polar regions to those in Syria and Tempe. For flank slope, the global and north polar regions display a significant latitude dependence, while the Syria Planum and Tempe-Mareotis regions

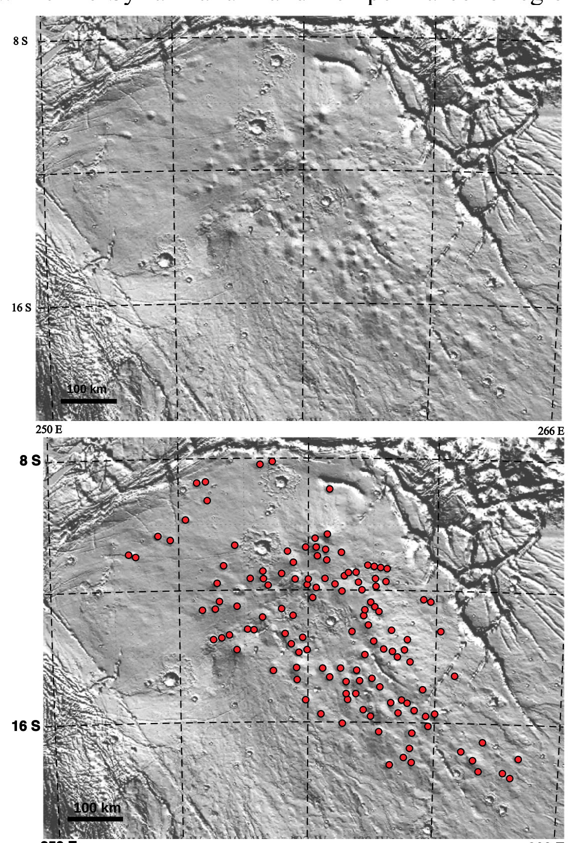

Fig. 1. (a) MOLA shaded relief topography of the Syria Planum Region showing some of the topographic variety and (b) locations of >125 small volcanic edifices.

show no correlation of flank slope to *local* latitude, although they are consistent with the global trends. Interestingly, many of the Tempe and Syria edifices show topographic traits (e.g. steep summit caps) that are linked to ESRP petrologic variations [6, 13-14].

Eastern Snake River Plains. Within the Quaternary (ESRP), Idaho, many low-volume, 5-25 km diameter, olivine tholeiite shields have unique steep-sided vent regions comprised of shelly pahoehoe, spatter, and breached spatter ramparts, which are manifested as topographic "caps" atop the more-normal-shield-like surrounding low-angle flanks [6,14]. The caps reflect a dramatic change in eruptive style, most likely related to viscosity changes as the local magma supply degassed. Other shields have less dramatic or even insignificant increases in near-vent slopes. Shields with caps typically have very coarsely diktytaxitic textures (angular open spaces between previously crystallized plagioclase laths possibly related to volatile-rich fluid losses) with large plagioclase grains, whereas medium-to-fine sub-ophitic textures (clinopyroxene and plagioclase crystals of about equal size) prevail in the shields without caps. Topographic GPS and DEM profiles show a link between steep-sided vent caps and coarsely diktytaxitic textures. One possible explanation is that cap shield magma supply is chemically more evolved than the supply to low-profile shields, yielding larger variations in magmatic and topographic properties [6,14].

Conclusions: While both the martian global and northern polar small edifice data show strong latitude dependence in some parameter trends that have been linked to a latitude dependence of volatile involvement in eruptions [9], the Syria Planum and Tempe Mareotis regions do not display similar trends locally. However, they do display a range of topographic features such as steep summit caps very similar to those seen in the ESRP, Idaho that have been recently linked to petrologic (and thus compositional and/or eruption) variations. Ongoing coordinated detailed topographic analyses of both the martian and terrestrial regions, as well as coupled petrologic analyses of ESRP data suggest that topographic profiling, along with remotely sensed chemical data, might be used to help determine if chemical evolution and vent area incompatible element enrichment on a factor for martian lava plains.

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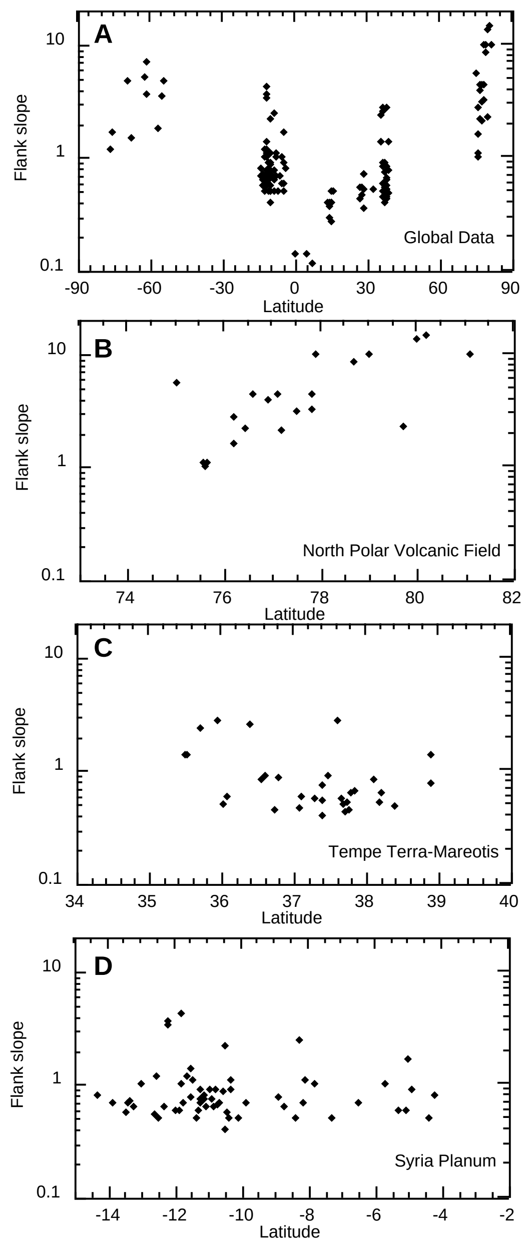

Fig. 2. Average flank slope vs. latitude for small volcanic edifices for global (A) data, the North Polar Volcanic Field (B), Tempe (C), and Syria (D).